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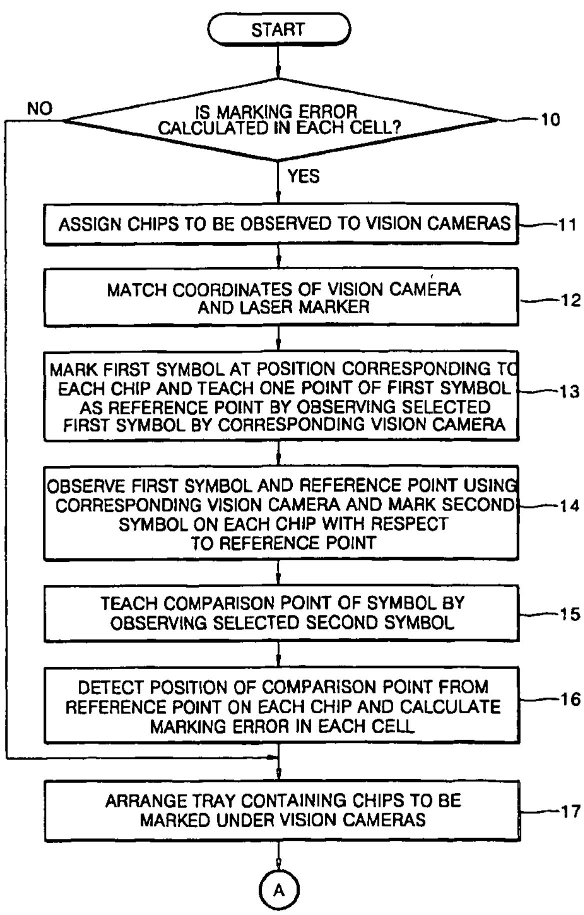
(54) Title: METHOD OF CALIBRATING MARKING IN LASER MARKING SYSTEM



(57) Abstract: In a method for calibrating marking in a laser marking system, (a) each chip is assigned to be observed to a corresponding vision camera, (b) a coordinate of the vision camera and a coordinate of the laser marker are matched, (c) a predetermined first symbol is marked on a chip or at a position corresponding to the chip, a selected first symbol is observed using the corresponding vision camera, and one point of the first symbol is taught as a reference point, (d) the first symbol and the reference point of the chip are observed using the corresponding vision camera and a second symbol is marked on the chip with respect to the reference point, (e) the second symbol on a selected chip is observed and one point of the second symbol is taught as a comparison point, and (f) a position of the comparison point is detected from the reference point on the chip and the marking error in each cell is calculated.

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METHOD OF CALIBRATING MARKING IN LASER MARKING SYSTEM

Technical Field

The present invention relates to a method of calibrating marking in a laser marking system using a vision camera, and more particularly, to a method of calibrating marking in a laser marking system which performs calibration considering a previously stored marking error while photographing a marking object.

Background Art

FIG. 1 is a plan view illustrating a typical lead frame strip. Referring to the drawing, a plurality of chips 12 are mounted on a strip 10 and characters and/or numbers are marked on a surface of each of the chips 12 to distinguish the chips 12 according to a production lot. A laser marker using a laser beam which will be described later is used as a piece of equipment for marking. An identification tag 14 is used for an arrangement of the strip 10.

The marking process using a laser marker on the strip 10 is an automatic process including handling of the strip 10 to improve an efficiency of marking.

FIG. 2 is a view showing a typical laser marking system. Referring to FIG. 2, a laser marking system includes a strip supply magazine 20 containing a plurality of strips 10, a loader 30 drawing one strip 10 from the strips in the magazine 20 and loading the strip 10 on a horizontal transfer table 22, a pre-vision camera 40 measuring an aligned state of the strip 10, a step motor 50 transferring the strip 10 on the horizontal transfer table 22 in one direction, a laser marker 60 marking characters on a plurality of chips on the strip 10 moved thereunder, a post-vision camera 70 photographing the marking on the marked strip 10, and an unloader 80 unloading the marked strip 10 into a strip collection magazine 90.

The strip 10 placed on the horizontal transfer table 22 by the loader 30 is photographed using the pre-vision camera 40. An identification tag, which is a strip itself or an etching line, is formed at one side of the strip 10 so that the aligned state can be easily recognized. The pre-vision camera 40 serves to guide only an aligned strip to the next marking process and an unaligned strip is bypassed so as to be reloaded in the strip supply magazine 20 or disposed of.

An arm 52 is accurately driven by the step motor 50 to position the strip 10 on the horizontal transfer table 22 to a set position, that is, under the pre-vision camera 40, the laser marker 60, and the post-vision camera 70.

FIG. 3 shows the structure of the laser marker. Referring to FIG. 3, the laser marker 60 includes a laser oscillator 61, a galvano scanner 63 scanning a laser beam on a predetermined region in an X-Y direction and an f-theta lens 64 forming a same focal distance of an incident laser beam in an entire marking area. X and y mirrors 63a and 63b reflect incident laser beams. Each of the x and y mirrors 63a and 63b is connected to a driving driver (not shown) to change an angle according to an input command.

The strip 10 marked with a predetermined character by the laser marker 60 is transferred under the post-vision camera 70 in a next step. The post-vision camera 70 determines the quality of marking by photographing the strip 10 so that an incorrectly marked strip is bypassed and a correctly marked strip is reloaded in the strip collection magazine 90 by the unloader 80.

FIG. 4 is a plan view depicting a typical tray 16 and chips **c** disposed therein. Referring to FIG. 4, the tray 16 is sectioned into cells accommodating the chips **c** so that a plurality of the chips **c** can be disposed. Since the size of each cell is rather greater than that of the chip, the chip may move in each cell when the tray 16 is transferred. Accordingly, when the chips are not aligned, a position of marking for each chip varies when each of the chips **c** in the tray 16 is marked by the

laser marker. Thus, if the marking position is not constant, the quality of a chip is questioned to be unreliable by a user.

When marking is performed to the chips in the strip, good marking is possible by observing only misalignment of the strip by the pre-vision camera. However, when the chips in the tray which are not aligned in each of the cells are marked by the above method, the quality of marking is remarkably deteriorated.

Disclosure of the Invention

To solve the above and/or other problems, the present invention provides a method of calibrating marking in a laser marking system by which marking is performed by detecting an alignment error for each chip and considering a marking error at the position of each chip.

According to an aspect of the present invention, there is provided a method for calibrating marking in a laser marking system including a laser marker performing marking while observing chips contained in cells of a tray using a plurality of vision cameras, and a post-vision camera detecting a marking error, which comprises the steps of (a) assigning each chip to be observed to a corresponding vision camera, (b) matching a coordinate of the vision camera and a coordinate of the laser marker, (c) marking a predetermined first symbol on a chip or at a position corresponding to the chip, observing a selected first symbol using the corresponding vision camera, and teaching one point of the first symbol as a reference point, (d) observing the first symbol and the reference point of the chip using the corresponding vision camera and marking a second symbol on the chip with respect to the reference point, (e) observing the second symbol on a selected chip and teaching one point of the second symbol as a comparison point, and (f) detecting a position of the comparison point from the reference point on the chip and calculating the marking error in each cell.

The step (a) comprises the sub-steps of (a1) attaching a marking paper on the tray or a surface of a plate having the same shape as that

of the tray, and arranging the tray or the plate disposed under the vision cameras, (a2) marking a point in each cell using the laser marker, and (a3) searching for the point using the vision cameras and determining the vision camera to observe each cell.

The point is a central point of each cell.

The step (b) comprises the sub-steps of (b1) marking corner points of a corresponding cell area with respect to the central point using the laser marker, and (b2) detecting positions of the corner points using a corresponding vision camera and matching a coordinate system of the laser marker and a coordinate system of the corresponding vision camera.

In the step (c), a corner of the first symbol is pointed by a pointing device while the first symbol is monitored through a display connected to the vision cameras.

in the step (e), a corner of the second symbol is pointed by a pointing device while the second symbol is monitored through a display connected to the post-vision camera.

The method further comprises the steps of (g) arranging the tray containing chips to be marked disposed under the vision cameras, (h) observing a selected chip using the corresponding vision camera and teaching one point on the chip as a marking reference point, (i) photographing each chip using the corresponding vision camera and calculating an alignment error of each chip, and (j) performing marking by correcting the marking error and the alignment error with respect to the marking reference point of each chip.

In the step (h), a corner of the chip is pointed by a pointing device while the chip is monitored through a display connected to the vision cameras.

The step (i) comprises the sub-steps of (i1) photographing the chip, and (i2) measuring x and y deviations of the marking reference point of the photographed image from the marking reference point of a reference image and an inclination of the photographed image from the reference

image.

Brief Description of the Drawings

FIG. 1 is a plan view illustrating a typical lead frame strip;

FIG. 2 is a view illustrating a typical laser marking system;

FIG. 3 is a view illustrating the structure of the laser marker of FIG. 2;

FIG. 4 is a view illustrating a typical tray and chips disposed therein;

FIG. 5 is a view illustrating the structure of a laser marking system adopting a marking calibration method according to a preferred embodiment of the present invention;

FIG. 6 is a view illustrating the structure of the laser marker of FIG. 5;

FIGS. 7A and 7B are flow charts for explaining a method of calibrating marking in a laser marking system according to the present invention;

FIG. 8 is a flow chart for explaining a preferred embodiment of Step 11 shown in FIG. 7A;

FIG. 9 is a flow chart for explaining a preferred embodiment of Step 12 shown in FIG. 7A;

FIG. 10 is a view depicting the measurement of a marking error in each cell;

FIG. 11 is a view depicting the measurement of an alignment error of a chip; and

FIG. 12 is a flow chart for explaining a preferred embodiment of Step 20 shown in FIG. 7B.

< Description of references in the drawings >

10: strip	12: chip
14: identification tag	20, 120: supply magazine
22.12: horizontal transfer table	30, 130: loader

40: pre-vision camera	50, 150: step motor
60, 160: laser marker	61, 161: laser oscillator
63, 163: galvano scanner	63a, 163a: x mirror
63b, 163b: y mirror	64, 164: f-theta lens
100: control unit	16, 110: tray
165: vision camera	167: light

Best Mode for Carrying out the Invention

FIG. 5 is a view illustrating the structure of a laser marking system adopting a marking calibration method according to a preferred embodiment of the present invention. In the drawing, the same names are used for the same elements as those in the conventional invention and detailed descriptions thereof are omitted.

A laser marking system 160 includes a tray supply magazine 120 containing a plurality of trays 110, a loader 130 drawing one of the trays 110 from the tray supply magazine 120 and aligning the drawn tray 110 on a horizontal transfer table 122, a step motor 150 transferring the tray 110 on the horizontal transfer table 122 in one direction, a laser marker 160 marking a character on each chip in a cell of the tray 10 transferred thereunder, a post-vision camera 170 photographing a marking on the marked tray 110, and an unloader 180 unloading the marked tray 110 into a tray collection magazine 190. Further, the laser marking system includes a control unit 100 controlling the loader 130, the step motor 150, the laser marker 160, the post-vision camera 170, and the unloader 180.

The post-vision camera 170 is a CCD camera. A CCD (charge coupled device) is a photoelectric transformation sensor changing light into an electric signal. The intensity of light incident on a lens (not shown) of the post-vision camera 170 is first recorded on the CCD. The light of a photographed image is separated into different colors by an RGB color filter attached to the CCD. The separated color is converted into an electric signal by hundreds of thousands of photodetectors constituting the CCD, each of which corresponds to one pixel. An

analog signal output from the CCD is converted into a digital signal of 0s and 1s so that an image signal is output. The post-vision camera 170 receives light from the tray 110 and generates an electric image signal. An image signal photographed by the post-vision camera 170 is transmitted to the control unit 100.

FIG. 6 is a view illustrating the structure of the laser marker of FIG. 5. Referring to FIG. 6, the laser marker 160 includes a laser oscillator 161, a galvano scanner 163, an f-theta lens 164, a vision camera 165 generating an electric image signal by receiving light from a plurality of chips **c** to be marked in the tray 110, a light 167 emitting light to the tray 110, a controller (not shown) controlling an x mirror 163a and a y mirror 163b of the galvano scanner 163 according to the information about the position of the chip output from the vision camera 165.

The galvano scanner 163 includes the x mirror 163a, the y mirror 163b, and a motor (not shown) driving each of the x and y mirrors 163a and 163b, and scans a laser beam on a predetermined region in an X-Y direction by adjusting the positions of the mirrors 163a and 163b.

The f-theta lens 164 forms a same focal distance of the incident laser beam in the entire portion of the tray 110.

The vision camera 165 uses a CCD camera like the post-vision camera 170. Preferably, one or a plurality of the vision cameras 165 are arranged to photograph the entire length of the tray 110 in a direction perpendicular to a direction in which the tray 110 is transferred. Thus, the number of the vision cameras 165 to be used is determined according to the size of the tray 110 and the field of view of the camera. For example, when a long side of the tray 110 along a direction in which the tray is transferred is 320 mm, a short side of the tray 110 in a direction perpendicular to the long side is 150 mm, and the field of view of the vision camera 165 is 100×100 mm, if two vision cameras are arranged perpendicularly to the tray transfer direction and the tray 110 is successively moved four times, by the step motor 150, so that the entire surface of the tray 110 can be photographed by the vision cameras. If

four vision cameras are arranged by 2×2 along the transfer direction, the tray 110 is successively moved two times, by the step motor 150 to cover the entire surface of the tray 110.

Preferably, a single post-vision camera is provided to observe a marking state while moving in a direction perpendicular to a direction in which the tray 110 is transferred.

The method of calibrating marking in a laser marking system using the laser marking system according to the present invention will be described below.

FIGS. 7A and 7B are flow charts for explaining a method of calibrating marking in a laser marking system according to the present invention.

First, whether a marking error is to be calculated in each cell is checked (Step 10). When it is determined in Step 10 that the marking error is calculated, in the case of using a plurality of vision cameras 165, for example, four vision cameras 165, chips to be observed are assigned to the vision cameras 165 (Step 11).

FIG. 8 is a flow chart depicting a preferred embodiment 11A of Step 11 shown in FIG. 7A.

Referring to FIG. 8, a marking paper (not shown) is attached on a surface of the tray 110 or a plate (not shown) having the same shape as the tray 110 and the tray 110 or the plate is disposed under the vision camera 165 (Step 30). For the marking paper, a white paper on which black ink is printed is used. Preferably, the surface of the marking paper is disposed at a focal length of the f-theta lens 164.

Next, the laser marker 160 marks a point, for example, a central point, on each cell (Step 32). The vision camera 165 to observe each cell is determined by searching for the central point using the vision cameras 165 (Step 34).

After Step 11, a coordinate system of each of the vision cameras 165 and a coordinate system of the laser marker 160 are matched (Step 12). In the above matching step, the coordinate systems are matched

since the unit of a coordinate viewed by the vision camera 165 is different from that of a coordinate viewed by the laser marker 160.

FIG. 9 is a flow chart for explaining a preferred embodiment 12A of Step 12 shown in FIG. 7A.

Referring to FIG. 9, the laser marker 160 marks points at the corners of a rectangle in an area corresponding to the cell with respect to the central point in Step 32 (Step 40) in the coordinate system of the laser marker 160.

Next, the positions of the corner points of a selected cell are detected by the vision camera 165 and the coordinate system of the vision camera 165 and the coordinate system of the laser marker 160 are matched in Step 42 (Step 42).

After Step 12, a predetermined first symbol S1 is marked at a position corresponding to each chip. A first symbol S1 of a selected chip is observed by a corresponding vision camera 165 on a display (not shown) connected to the vision camera 165, and one point of the first symbol S1 is pointed by a pointing device (not shown) as a reference point P1 (refer to FIG. 10). That is, the reference point P1 is taught to the corresponding vision camera 165 (Step 13).

Next, while each cell is observed by the corresponding vision camera 165, a second symbol S2 is marked with respect to the reference point P1 by searching the first symbol S1 and the reference point P1 (Step 14).

The tray 110 or the plate completing the above marking process is transferred under the post-vision camera 170 and observed by the post-vision camera 170 moving in a direction perpendicular to a direction in which the tray is transferred, preferably, one cell by one cell. An operator observes one of the chips on the display and points one point of the second symbol S2 using the pointing device and teaches a comparison point P2 to the post-vision camera 170 (Step 15).

Next, the reference point P1 and the comparison point P2 of each cell is detected by the post-vision camera 170 to measure the deviation

of the comparison point P2 with respect to the reference point P1. Then, by comparing the measured deviation with the predetermined deviation between two points P1 and P2, a marking error is calculated and stored in a memory (not shown) (Step 16). The marking error stored in the memory is used to correct adjustment values of the x mirror 163a and the y mirror 163b of the galvano scanner 163 to perform marking by correcting the marking error.

The marking error calculation process can be applied to a case in which the chips are regularly arrayed in each cell of the tray 110, or the chips are formed on a strip. However, when the chips are moved in the tray 110, an alignment error of each chip needs to be measured and corrected.

Next, the tray 110 containing chips in the cell is arranged at the same position as in Step 30 (Step 17). Whether a marking reference point is newly assigned is determined (Step 18). When it is determined in Step 10 hat the marking error in each cell previously stored in the memory is to be used, Step 17 is performed.

When it is determined in Step 18 that a new marking reference point is assigned, while the chip selected by the corresponding vision camera 165 is monitored, one point of the chip, for example, one corner point P3, is pointed by the pointing device so as to teach a marking reference point P3 to the corresponding vision camera 165 (Step 19) (refer to FIG. 11).

Next, the alignment error of each chip is calculated by photographing each chip using the corresponding vision camera 165 (Step 20). When it is determined in Step 18 that the previously stored marking reference point P3 is to be used, Step 20 is performed.

FIG. 12 is a flow chart for explaining a preferred embodiment 20A of Step 20 shown in FIG. 7B. Referring to FIG. 12, the position of each chip is photographed by the vision camera 165 (Step 50).

Next, by comparing a reference image of the chip (indicated by a dotted line of FIG. 11) and an image of each chip which is measured

(indicated by a solid line of FIG. 11), x and y deviations dx and dy of the marking reference point P3 from a point P0 of the reference image corresponding to the marking reference point P3, and an inclination angle θ of the measured chip, are measured (Step 52).

After Step 20, marking is performed by correcting the marking error of a corresponding cell calculated in Step 16 and the alignment error of each chip calculated in Step 52 with respect to the marking reference point P3 of each chip (Step 21). That is, considering the above errors, the x mirror 163a and the y mirror 163b of the galvano scanner 163 are adjusted and each chip is marked.

Although in the above preferred embodiment a method of marking each chip in a cell of a tray is described, the present invention can be applied to a method of calibrating marking by detecting a marking error of each chip when the respective chips formed on a strip are marked.

Also, although in the above preferred embodiment a method of calibrating marking in a marking system using a plurality of vision cameras is described, the present invention can be applied to a case where one width of a tray or a strip is observed using a single vision camera.

Industrial Applicability

As described above, in the method of calibrating marking in a laser marking system according to the present invention, a marking error in each cell and an alignment error in each chip are measured and the galvano scanner is controlled to correct these errors so that the quality of marking can be improved.

While this invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A method for calibrating marking in a laser marking system including a laser marker performing marking while observing chips contained in cells of a tray using a plurality of vision cameras, and a post-vision camera detecting a marking error, the method comprising the steps of:

(a) assigning each chip to be observed to a corresponding vision camera;

(b) matching a coordinate of the vision camera and a coordinate of the laser marker;

(c) marking a predetermined first symbol on a chip or at a position corresponding to the chip, observing a selected first symbol using the corresponding vision camera, and teaching one point of the first symbol as a reference point;

(d) observing the first symbol and the reference point of the chip using the corresponding vision camera and marking a second symbol on the chip with respect to the reference point;

(e) observing the second symbol on a selected chip and teaching one point of the second symbol as a comparison point; and

(f) detecting a position of the comparison point from the reference point on the chip and calculating the marking error in each cell.

2. The method of claim 1, wherein the step (a) comprises the sub-steps of:

(a1) attaching a marking paper on the tray or a surface of a plate having the same shape as that of the tray, and arranging the tray or the plate disposed under the vision cameras;

(a2) marking a point in each cell using the laser marker; and

(a3) searching for the point using the vision cameras and determining the vision camera to observe each cell.

3. The method of claim 2, wherein the point is a central point

of each cell.

4. The method of claim 3, wherein the step (b) comprises the sub-steps of:

(b1) marking corner points of a corresponding cell area with respect to the central point using the laser marker; and

(b2) detecting positions of the corner points using a corresponding vision camera and matching a coordinate system of the laser marker and a coordinate system of the corresponding vision camera.

5. The method of claim 1, wherein, in the step (c), a corner of the first symbol is pointed by a pointing device while the first symbol is monitored through a display connected to the vision cameras.

6. The method of claim 1, wherein, in the step (e), a corner of the second symbol is pointed by a pointing device while the second symbol is monitored through a display connected to the post-vision camera.

7. The method of claim 4, further comprises the steps of:

(g) arranging the tray containing chips to be marked disposed under the vision cameras;

(h) observing a selected chip using the corresponding vision camera and teaching one point on the chip as a marking reference point;

(i) photographing each chip using the corresponding vision camera and calculating an alignment error of each chip; and

(j) performing marking by correcting the marking error and the alignment error with respect to the marking reference point of each chip.

8. The method of claim 7, wherein, in the step (g), the tray is disposed at a position of the plate in the step (a1).

9. The method of claim 7, wherein, in the step (h), a corner of the chip is pointed by a pointing device while the chip is monitored through a display connected to the vision cameras.

10. The method of claim 7, wherein the step (i) comprises the sub-steps of:

(i1) photographing the chip; and

(i2) measuring x and y deviations of the marking reference point of the photographed image from the marking reference point of a reference image and an inclination of the photographed image from the reference image.

FIG. 1

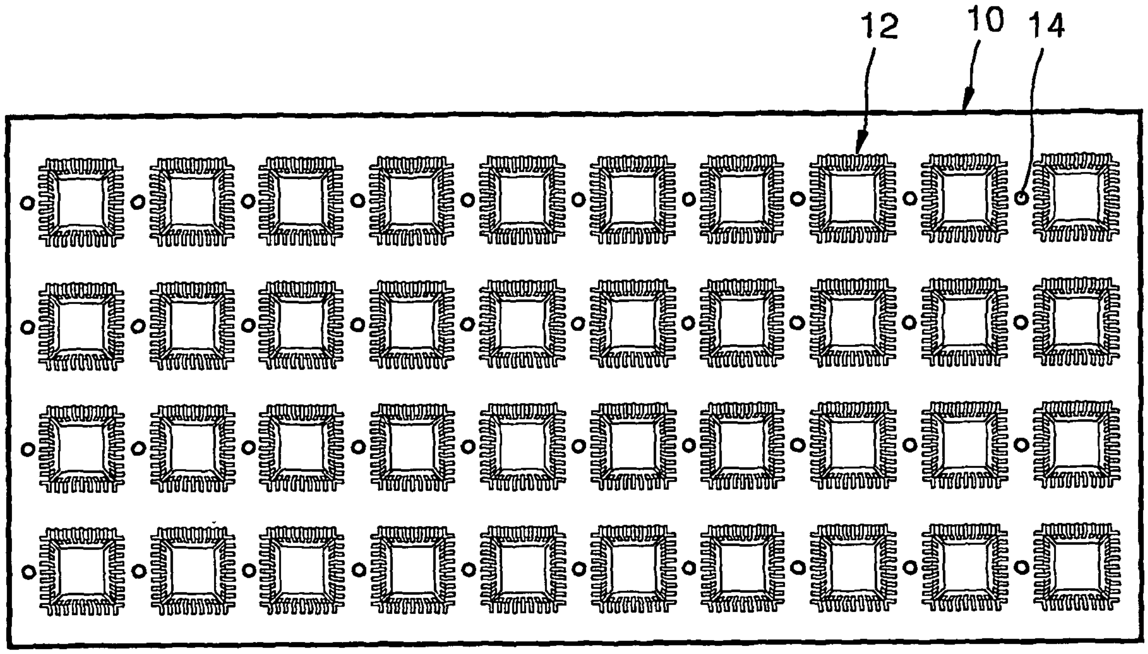


FIG. 2

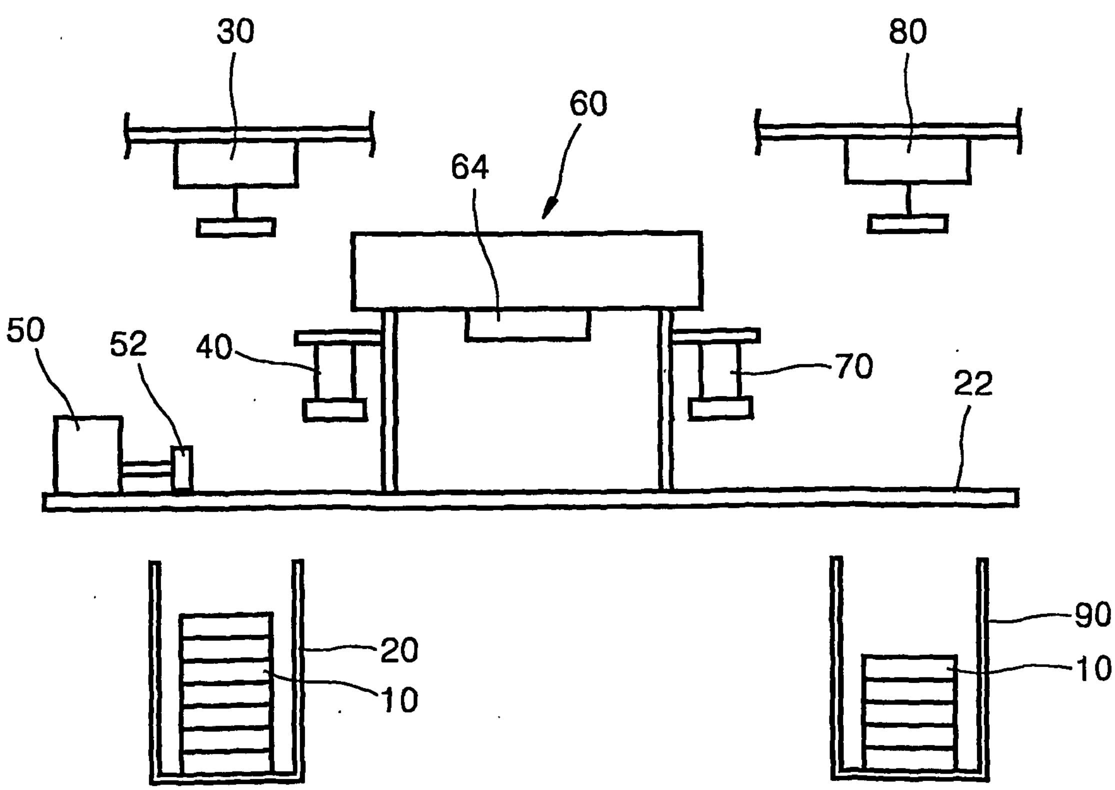


FIG. 3

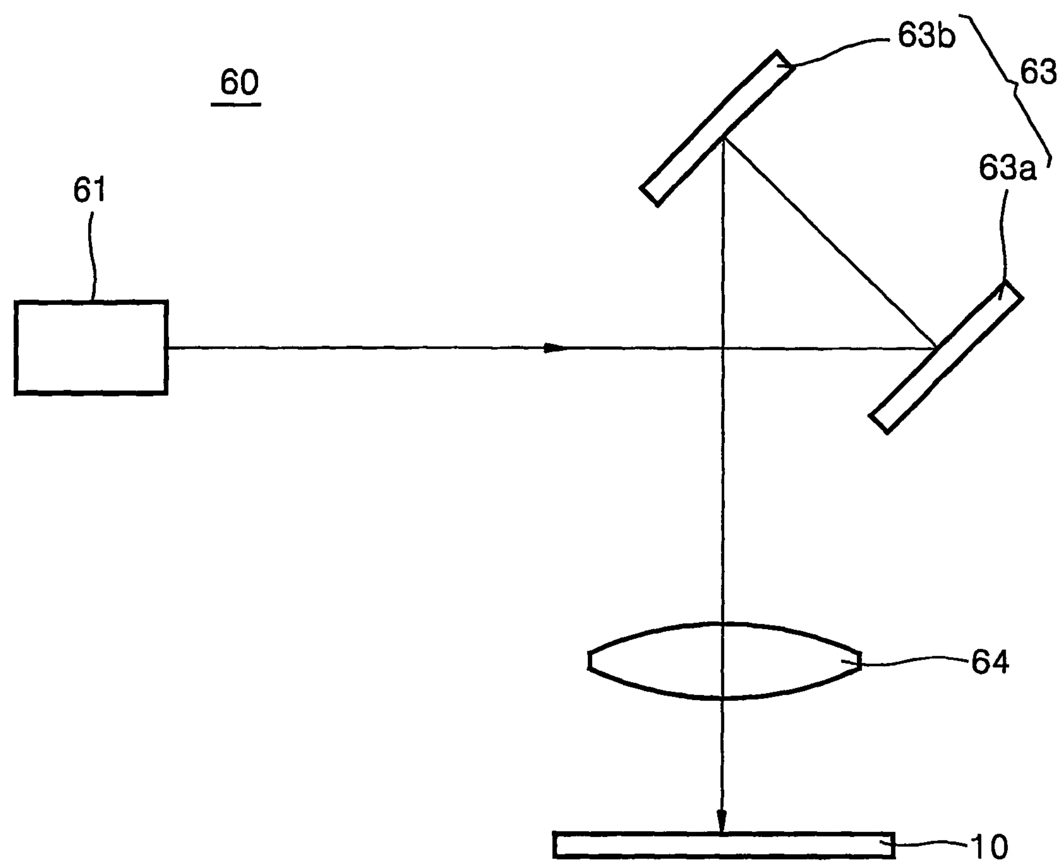


FIG. 4

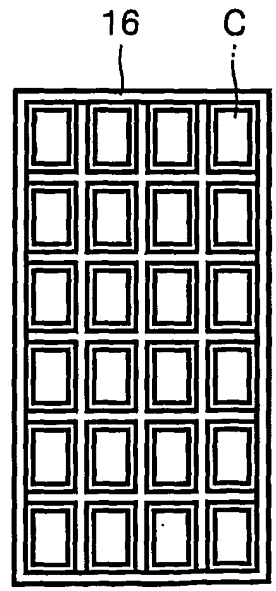


FIG. 5

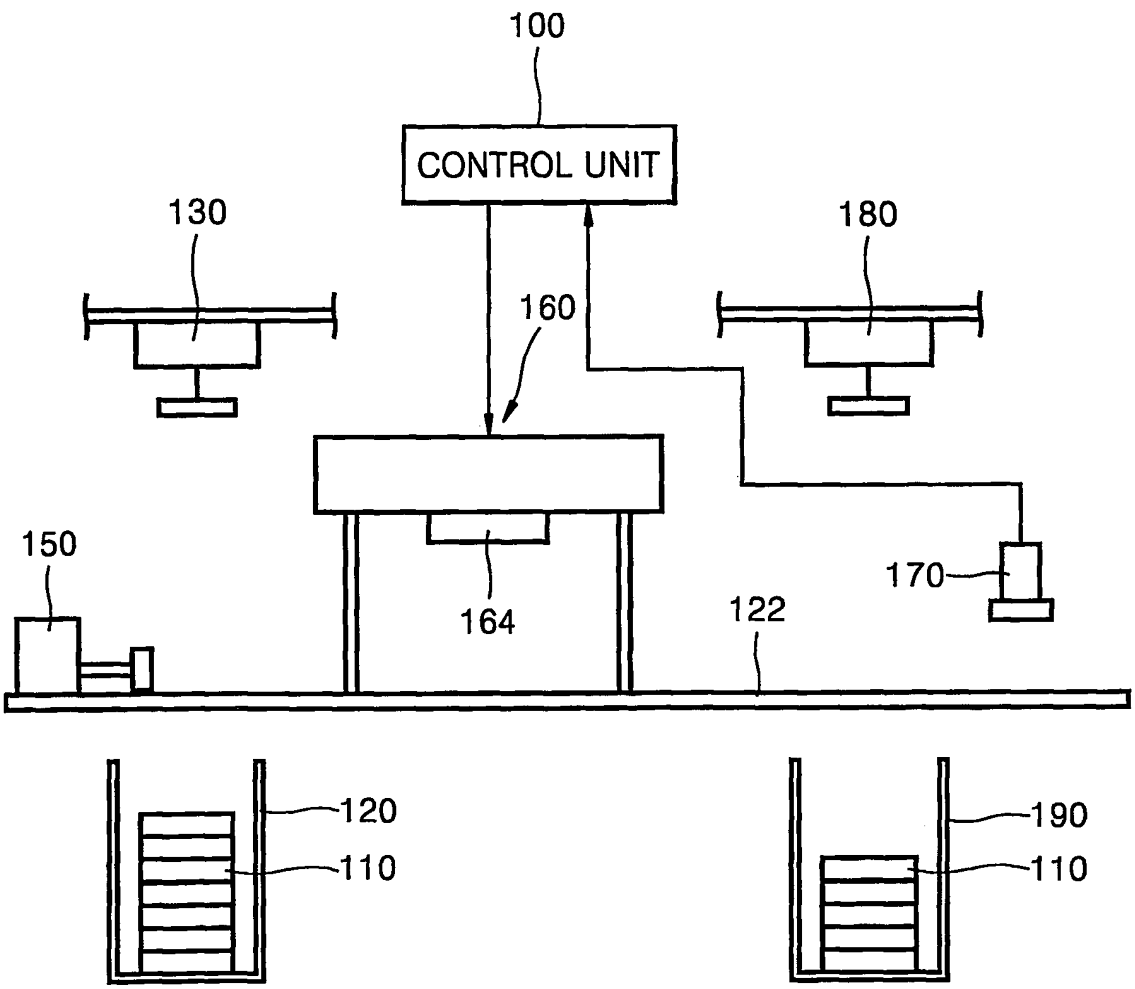


FIG. 6

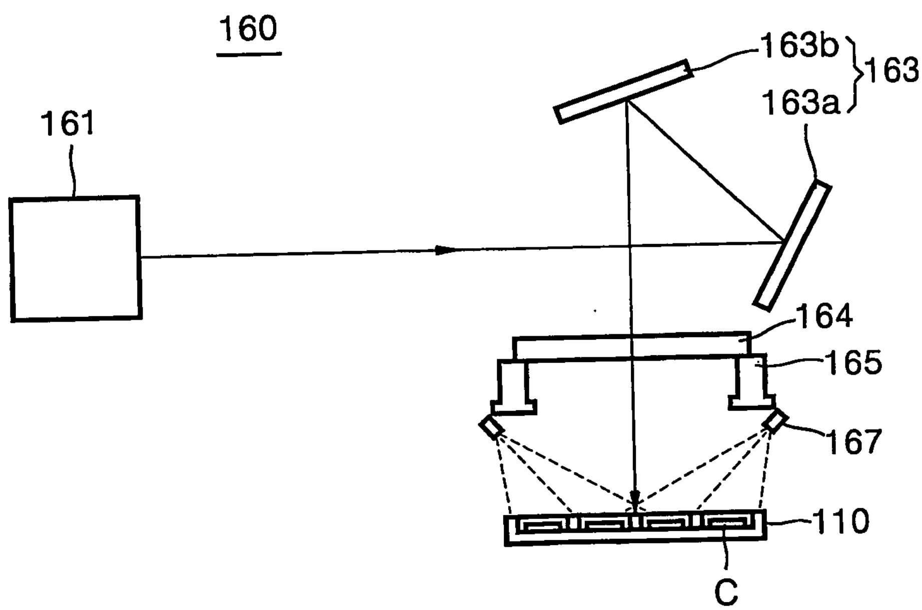
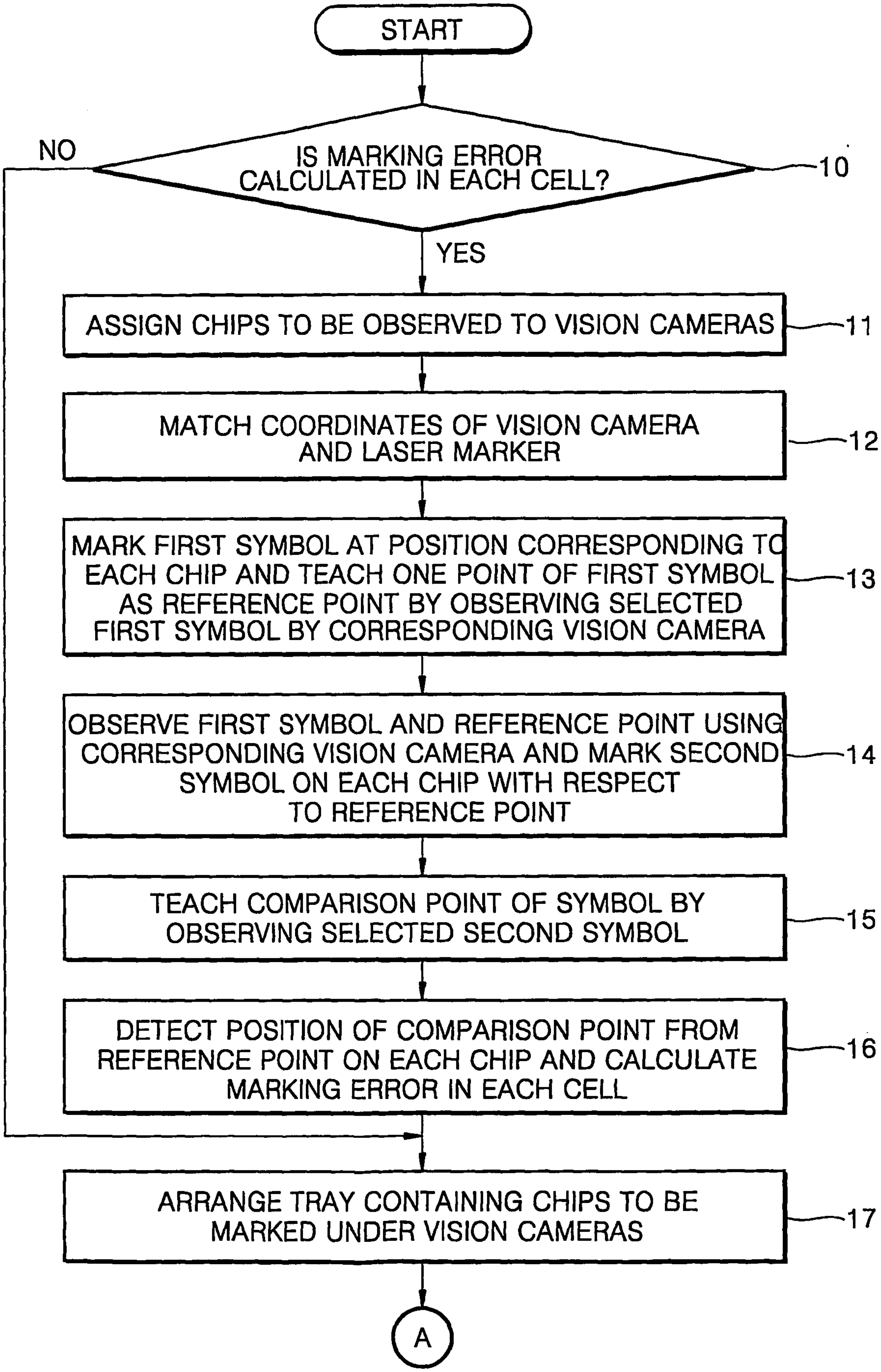


FIG. 7A



START
IS MARKING ERROR CALCULATED IN EACH CELL?
NO
YES
10
ASSIGN CHIPS TO BE OBSERVED TO VISION CAMERAS
11
MATCH COORDINATES OF VISION CAMERA AND LASER MARKER
12
MARK FIRST SYMBOL AT POSITION CORRESPONDING TO EACH CHIP AND TEACH ONE POINT OF FIRST SYMBOL AS REFERENCE POINT BY OBSERVING SELECTED FIRST SYMBOL BY CORRESPONDING VISION CAMERA
13
OBSERVE FIRST SYMBOL AND REFERENCE POINT USING CORRESPONDING VISION CAMERA AND MARK SECOND SYMBOL ON EACH CHIP WITH RESPECT TO REFERENCE POINT
14
TEACH COMPARISON POINT OF SYMBOL BY OBSERVING SELECTED SECOND SYMBOL
15
DETECT POSITION OF COMPARISON POINT FROM REFERENCE POINT ON EACH CHIP AND CALCULATE MARKING ERROR IN EACH CELL
16
ARRANGE TRAY CONTAINING CHIPS TO BE MARKED UNDER VISION CAMERAS
17
A

FIG. 7B

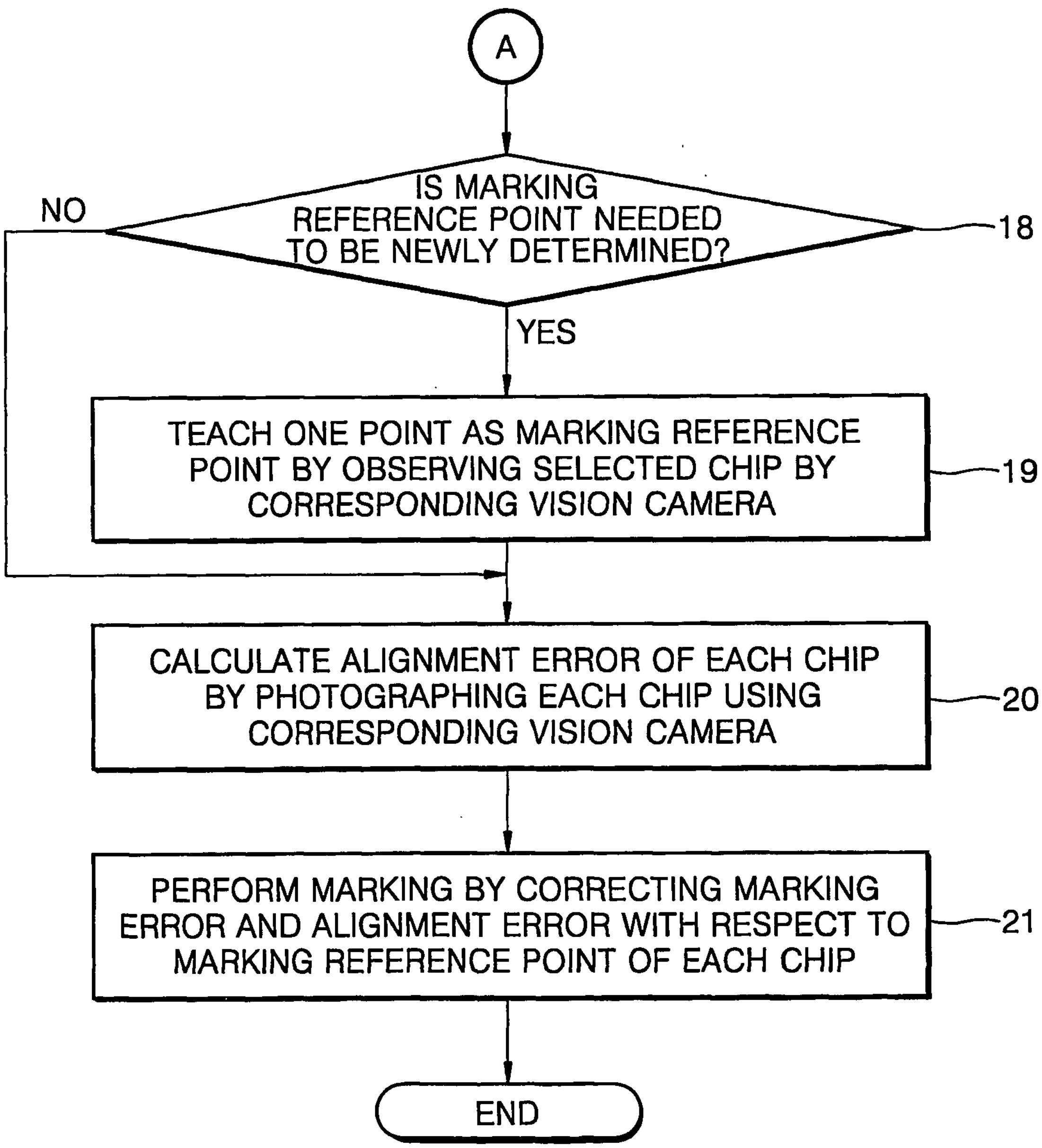

A
IS MARKING REFERENCE POINT NEEDED TO BE NEWLY DETERMINED?
NO
18
YES
TEACH ONE POINT AS MARKING REFERENCE POINT BY OBSERVING SELECTED CHIP BY CORRESPONDING VISION CAMERA
19
CALCULATE ALIGNMENT ERROR OF EACH CHIP BY PHOTOGRAPHING EACH CHIP USING CORRESPONDING VISION CAMERA
20
PERFORM MARKING BY CORRECTING MARKING ERROR AND ALIGNMENT ERROR WITH RESPECT TO MARKING REFERENCE POINT OF EACH CHIP
21
END

FIG. 8

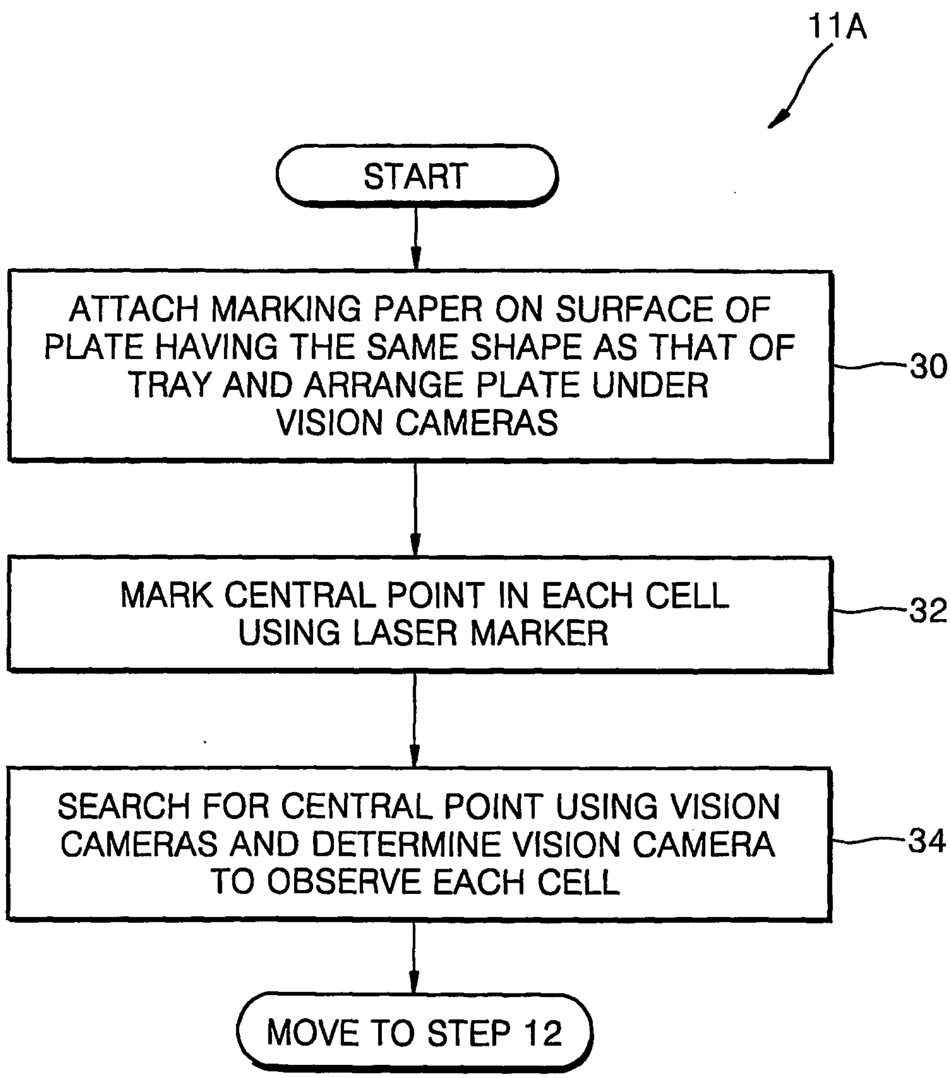

11A
START
ATTACH MARKING PAPER ON SURFACE OF PLATE HAVING THE SAME SHAPE AS THAT OF TRAY AND ARRANGE PLATE UNDER VISION CAMERAS
30
MARK CENTRAL POINT IN EACH CELL USING LASER MARKER
32
SEARCH FOR CENTRAL POINT USING VISION CAMERAS AND DETERMINE VISION CAMERA TO OBSERVE EACH CELL
34
MOVE TO STEP 12

FIG. 9

12A

START

↓

MARK CORNER POINTS OF CORRESPONDING CELL AREA WITH RESPECT TO CENTRAL POINT USING LASER MARKER — 40

↓

DETECT POSITIONS OF CORNER POINTS USING CORRESPONDING VISION CAMERA AND MATCH COORDINATE OF LASER MARKER AND COORDINATE OF CORRESPONDING VISION CAMERA — 42

↓

MOVE TO STEP 13

FIG. 10

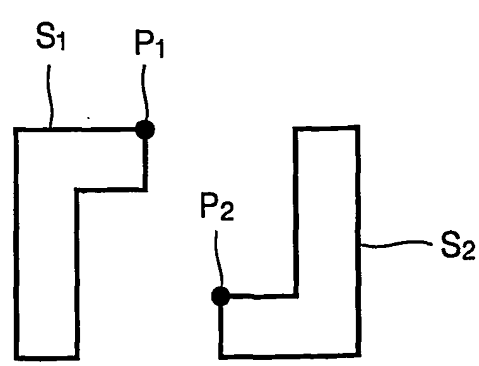


FIG. 11

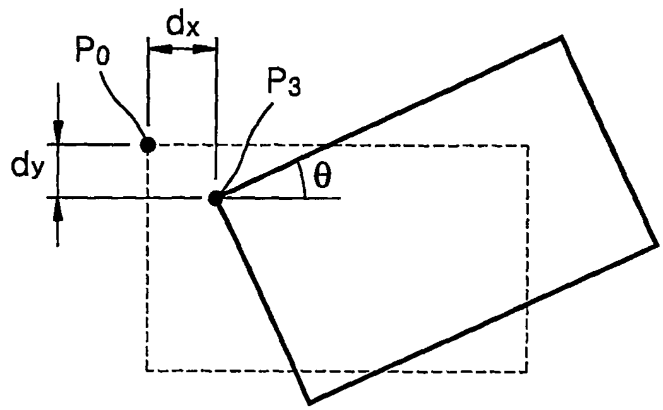
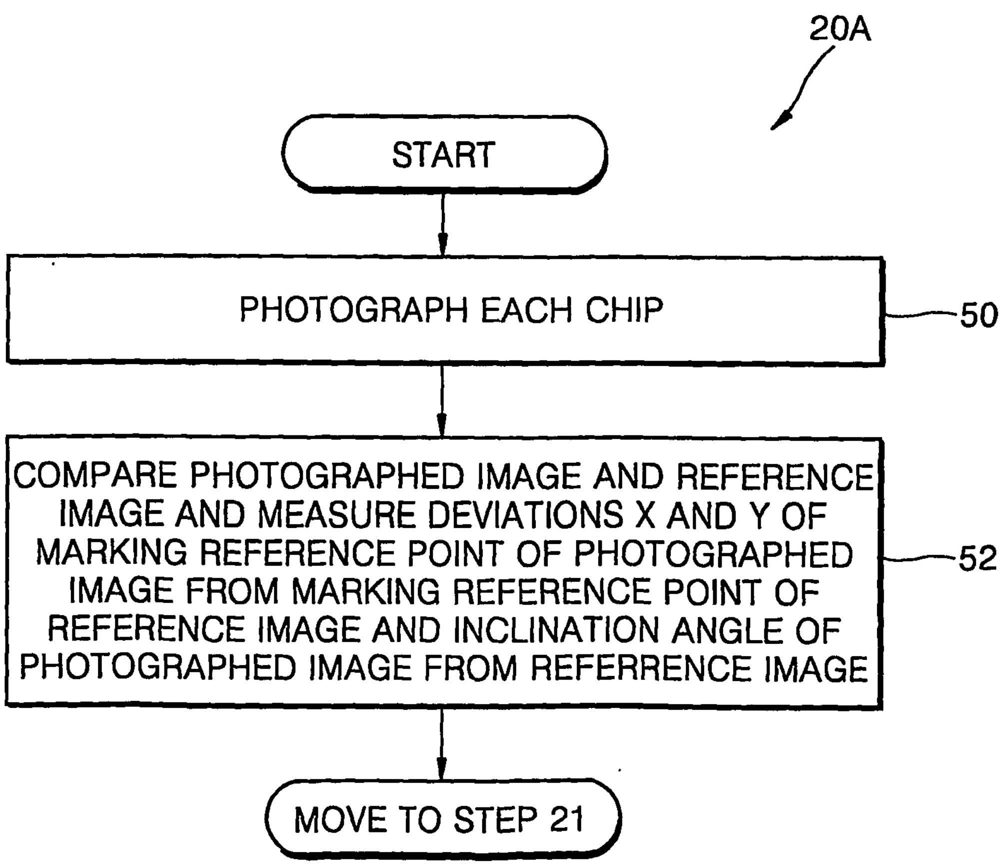

dx
P0
P3
dy
θ

FIG. 12


20A
START
PHOTOGRAPH EACH CHIP
50
COMPARE PHOTOGRAPHED IMAGE AND REFERENCE IMAGE AND MEASURE DEVIATIONS X AND Y OF MARKING REFERENCE POINT OF PHOTOGRAPHED IMAGE FROM MARKING REFERENCE POINT OF REFERENCE IMAGE AND INCLINATION ANGLE OF PHOTOGRAPHED IMAGE FROM REFERRENCE IMAGE
52
MOVE TO STEP 21

INTERNATIONAL SEARCH REPORT

rnational application No.
PCT/KR03/00841

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H01L 23/544

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC H01L23/544 H01L21/66 H01L21/68

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

eKIPASS "mark" "camera" "error" "identification" "tray" "test"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 99-78833 A (HIMS CORP.) 5 NOVEMBER 1999 See the whole document	1 -10
A	KR 00-08807 U (HYUNDAI CORP.) 25 MAY 2000 See the whole document	1-10
A	JP 04-330754 A (TOSHIBA CORP.) 18 NOVEMBER 1992 See the whole document	1-10
A	JP 01-318947 A (HITACHI LTD) 25 DECEMBER 1989 See the whole document	1-10
A	JP 01-194322 A (CANON INC) 4 AUGUAST 1989 See the whole document	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 AUGUST 2003 (14.08.2003)	14 AUGUST 2003 (14.08.2003)

Name and mailing address of the ISA/KR	Authorized officer
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